D-E-2266

MAY 28 1951

MEMORANDUM FOR: DIRECTOR OF NAVAL INTELLIGENCE
Attention: Commander H. C. Lawder
Room 5E 719, Pentagon

SUBJECT: German Optical Torpedo Exploder

1. Forwarded herewith as Appendices A, B. and C are descriptions of a German optical torpedo exploder. This exploder, called "Leuchtfisch", was in the final stages of development at the end of World War II.

2. The inventor now desires to sell a complete working model (Appendix B) or a number of the exploders, together with the manufacturing rights (Appendix C) to the United States. It is believed that a sample exploder could be obtained at a cost deemed reasonable by the Department of the Navy.

3. The data contained in Appendices B and C is in reply to questions informally obtained from your office after a preliminary review of the descriptive data listed in Appendix A.

4. It is requested that this Office be advised as soon as practicable of what further action should be taken by this agency on your behalf.

[redacted]
Acting Assistant Director
Scientific Intelligence

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1. Appendix A
2. Appendix B
3. Appendix C
cc: TGS/SO

Appendix A

30 January 1951

Transmission of Command Signals by Light Over Long Distances

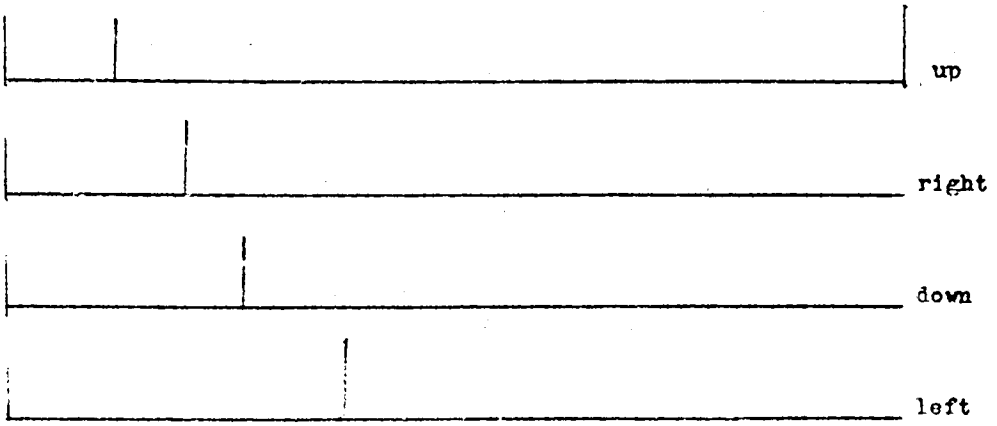
1. Following are the details dealing with an invention to control the operation of missiles and the explosion of torpedoes by means of light signals over a large distance, operating on the principle of the Stroboscope:

Missiles

a. By means of a gaseous discharge lamp of quarts containing primarily Argon at 3 to 5 atmpsphere pressure and operating on the principle of the Stroboscope, intense light flashes of short duration were obtained. The secret of obtaining the high intensity is to a slight extent in the lamp, but primarily in the circuits which results in the spark resistance being equal to the periodic limit resistance. The intensity of the resulting light flash was $10^{11}$ candle power or $10^{11}$ Lux. The intensity at 10,000 meters was theoretically therefore $10^{11} \times 10^{-8}$ or 100 Lux. Due to atmospheric absorption and other effects, the intensity was about 10 Lux at 15,000, and sufficient to actuate the photocell. The peak of the flash was obtained in $10^{-7}$ seconds and the useful wave-lengths were in the 3000-3600 A° region with the maximum intensity between 3500 and 3600 A°. In this region the effect of solar radiation was about 1 Lux in spite of the fact that the intensity of the light from the sun was about 50,000 Lux. As long as the effect of impulses from the transmitter were 5 or 6 times that of the effect of the sun in the photocell, command signals could be transmitted.

b. To direct the beam a mirror of a 35 cm diameter was used.

c. Command signals were given by means of three impulses with the differences between signals determining the command. For example, command would appear as follows:



d. The receiver is an ordinary type photo-tube 10 cm in diameter and with angle of view of 140°. If desired, filters can be used on the transmitter and receiver.

e. The experimentation was concerned only with the method of transmitting command signals by means of light over large distance. No work has been done with the ballistics of the missile or the means of converting the signals to effective commands, or with the actual control of the missile in flight. The equipment could be used in either a glide bomb or an antiaircraft missile. Naturally, with the use of light, the transmitter must be kept directed on the missile at all times.

Torpedo Exploder

f. The torpedo exploder operates on the same general principle but with either ultra-violet or infra-red radiations. The transmitter using a much smaller mirror than the 35 cm used in the plane with the glide bomb is located in the forward part of the torpedo and sends out intense flashes upward and slightly to the rear. The receiver located in the after-portion of the torpedo watches upward and slightly forward. Activation of the exploder can be made dependent upon a definite number of flashes being reflected, and so give the torpedo some powers of discriminating the beam of target ships. Depending upon water composition, the device is effective from 6 to 12 meters below the hull of the target ship. Out of about 1000 test firings with the exploder device, it functioned satisfactorily 100% of the time after the first several tests.

2. It is requested that TGS ascertain as quickly as possible whether the US navy and/or Air Force would be interested in obtaining further information on the subject. If further information is desired and we are notified soon enough, arrangements can be made for its procurement.

Appendix B

MEMORANDUM TO: Assistant Director
Office of Scientific Intelligence

2 April 1951

ATTENTION [ ] Weapons Division

FROM : TGS/OSO

SUBJECT : Torpedo Exploder

1. Reference is made to our previous conversations concerning an invention to control the operation of missiles and the explosion of torpedoes by means of light signals over a large distance, operating on the principle of the Stroboscope. As you probably recall, this invention has been offered to the United States. On 30 January we requested that you ascertain if either the Navy or the Air Forces would be interested in further data on this subject. On 1 February you submitted to this office by hand certain essential questions concerning this device, the answers to which would determine our further interest.

2. The following are answers to these questions.

a. Sensitivity and Wave-Length Range of Receiver

The sensitivity of the receiver is $10^{-5}$ lumens or about $0.3 \times 10^{-7}$ watts. The useful wave lengths possible are either in the infra-red or ultra-violet range and cover respectively 7000-8500 A° and 3600-4200 A°.

b. Conditions under which Test Firings were made

The exploder was developed in Dr. Ing. Frank Frügel's laboratory in Danzig during the period 1940-1944. Here tests and measurements were made to determine the efficiency of the equipment in water of various compositions. In the Summer of 1944 tests were begun at the Torpedoversuchsanstalt, Eckernfeerde bei Kiel. The Abteilung Leiter was Dr. Lerp and Fruengel's group was under Wilfred Zwake, as Fruengel remained in Danzig.

Altogether 20 complete sets of equipment were made and 10 torpedoes of normal types were modified to use the exploders. The torpedoes were fired in a test area seven kilometers in length, using ships or simulated ships of various beams. The results of the tests with the exploder were determined by means of an oscillograph. At the end of the run a bouy was released by the torpedo by which the torpedo was recovered for further tests. In addition to using the oscillograph, a number of tests were made in which a marker was released at the time the torpedo would have exploded. No tests were made with a live warhead, or in combat. Tests were run under various conditions of lighting, such as full sunlight, overcast, at night using searchlights, and on completely dark nights. The torpedo functioned perfectly in all conditions and in no instance was the signal light detected visually. These tests continued until about February 1945.

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c. Stage of Development

The development of the exploder was considered complete in 1945 and it was accepted for use by the German Navy. Production of the equipment was scheduled to begin in the summer of 1945 at Gema, Berlin-Koepenick.

d. Electrical Installations and Capacities Necessary to Transmit Signal

The electrical equipment is small and simple. Required are battery, thriller, ignition coil, rectifier, pulse condenser, and spark gap. The model developed by Fruengel required 30-40 watts and operated on 24 volts and 500 cycles. These conditions can be varied to suit the electrical system in use in the torpedo. The capacity of batteries used was ½ ampere hours. The mirror for the transmitter is 15-20 centimeters in diameter.

The signal is picked up by a photo cell 5 to 8 $cm^2$ in size and a mirror of 15 to 20 cm in diameter. The receiver consists of 4 tubes (2 x RV12P2001, 2 x RV12P2000) and 1 Thyratron (EL50). The power supply for the receiver can be either a dry battery giving 120 volts and 15 milliamperes or a continuous current dynamotor.

3. Wilfred Zwaka is working in Braunschweig producing similar equipment or parts for such equipment, and Zwaka and Fruengel have business connections. Details such as Zwaka's exact work, whether he is employed or has his own firm are not known.

4. A complete model of the torpedo exploder could be acquired in about six weeks for about 12,000 DMs.

5. In light of the above information, it is requested that you again immediately contact your original customer agency or agencies to ascertain if they are now interested in procuring this device.

Appendix C

BY HAND

MEMORANDUM TO: Office of Scientific Intelligence — 25 May 1951

ATTENTION : [redacted] Weapons Division — Memo No. 915

FROM : TCS/OSO

SUBJECT : Torpedo Exploder

1. Reference is made to TCS Memo No. 796 of 31 March 1951 and to conversation with [redacted] of OSI and Col. Reader and [redacted] of TCS/OSO of 10 April 1951 concerning a German torpedo exploder. In reply to the questions left with us by Mr. Lexov, we have received today the following information. Regarding the documentary evidence of the test firings of the torpedo, there is apparently only a letter which is on film which states that the torpedo exploder had been tested and that production should be started. We expect to receive a copy of this letter in the near future. However, we feel that it will be merely a copy of one of the letters already in our possession concerning the Leuchtfisch. Reportedly correspondence on the Leuchtfisch was scant as work on it was more secret than work on the glide bomb control. The twenty torpedo exploders for the Leuchtfisch were destroyed by the Germans at the end of the war, along with documents and equipment at Echernfaerde.

2. The following proposals concerning payment have been made: During the war development work by the inventor cost about 3/4 million marks, 80,000 of which the inventor never collected and is now unable to collect. He now wants us to pay the cost of the number of exploders we may want to buy initially (about 12,000 DM per set or perhaps a little more due to rising costs) and reimburse him for the 80,000 DM. Payment would be made as follows: 1/3 when the contract is signed; 1/3 when the set is completed; and the final 1/3 when the exploder has been accepted. If we decide to accept the exploder, he will make complete settlement, giving us all rights, for the equivalent of the cost of one torpedo. This he estimates to be approximately $80,000. He wants this in Canadian dollars, as he hopes to go to Canada eventually.

3. The inventor is willing to visit the U.S. to discuss any aspects of the exploder (Leuchtfisch) if it is accepted by us.

4. It is believed that the inventor is a sincere and capable man, and that his terms are not unreasonable. He was told that his proposal would be passed along to the proper authorities, but that in the event we decided to test his exploder we would no doubt have a final proposal of our own. This he apparently expected.

5. It is imperative that we have a decision on this as soon as possible as we have a deadline to meet in giving our final decision to the inventor. If the U.S. is not interested, he is considering presenting his ideas to another Western country. This cannot be considered unreasonable as we have been in negotiation with him for many months.

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SECRET

6. It is requested that you discuss this matter with Navy at your earliest convenience and give us specific information as to what commitments we can make.



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